

REMARKS

Claims 1-4 and 6-7 stand rejected under 35 U.S.C. 102 (b) as being anticipated by US Patent No. 4,263,380 (Riedl). Applicant appreciates the examiner's thoroughness in describing various details in Riedl's disclosure. However, existing claims 1-4 and 6-7 are believed to be patentable because both of the subject application's independent claims (i.e. claims 1 and 3) include the following limitation: "wherein neither said cover nor said container's open end are crimped thereby forming an adhesively secured, non-crimped electrochemical cell." The words "crimped" and "non-crimped", when defined in a manner that is consistent with the subject application's written description and figures, distinguish the subject invention over the disclosure in Riedl. Applying the proper definition to the words crimped and non-crimped is essential to understanding the scope of the claim. According to the examiner's comments made during the prosecution of the parent application, now US 6,605,383, the examiner stated that "the term crimping in the battery art means pressing or pinching into small, regular folds or ridges. ... Fig. 1 does not show crimping (pressed or pinched regular folds or ridges) contrary to Applicant's assertion. Therefore Fig. 1 is not held to teach or suggest a crimped cell." See the office action mailed on December 12, 2002, page 6, second full paragraph. For convenience, a copy of page 6 is attached hereto as Attachment A. The applicant respectfully disagrees with this definition of crimping because it is (1) inconsistent with the description of a crimped cell in the applicant's application; (2) inconsistent with how the term has traditionally been used in the art as evidenced by the reference cited below; (3) does not encompass the most appropriate meaning of the word "crimp" as it is defined in a standard dictionary, and (4) is inconsistent with Reidl's use of the word crimping.

In the specification, the applicant describes assembling an electrochemical cell as including "crimping the edge of the can over the peripheral edge of the collector and seal assembly and outer cover to secure the outer cover and collector assembly within the open end of the steel can." See page 2, lines 4-6. There is no indication that the edge of the can was pressed or pinched into small, regular folds or ridges. In particular, the wording "crimping the edge of the can over the peripheral edge of the collector" would lead a skilled person to conclude that the

open end of the can was rolled or bent inwardly over the collector seal assembly that had been inserted into the can. This interpretation is consistent with a more applicable definition of crimp, as shown in Webster's New Collegiate Dictionary, 150th Edition, which defines crimp as "to roll the edge of". Furthermore, this definition is consistent with the use of the word "crimping" in US 4,015,055 which describes the process used to make the cells in example 1 as follows:

"These components, along with a 33% KOH electrolyte (7.7 M KOH) which was employed in excessive amount so as to effectively fill the voids of the cathode material, were assembled in a nickel-plated cathode container and a gold-plated copper clad stainless steel anode cup and then the cell was sealed by crimping the top annular section of the cathode container inwardly against the anode cup via a grommet of nylon as described in U.S. Pat No. 3,069,489." (underlining was added). See column 6, line 62 to column 7, line 2. Similarly, in column 5, line 65 to column 6, line 1, the word "crimped" is used as follows: "As shown, cathode container 5 has a flange 7 which is crimped inwardly against a U-shaped flange 11 on anode cup 6 via grommet 8 during assembly to seal the cell as disclosed, for example, in U.S. Pat. No. 3,069,489." (underlining was added). For convenience, copies of the first page, the sheet containing columns 5 and 6, and the sheet containing columns 7 and 8, from US 4,015,055 are attached as attachments B1, B2 and B3. The drawing on the first page clearly shows the flange 7 of cathode container 5 as crimped inwardly toward the U-shaped flange. There is a strong similarity between the structure of the crimped cell shown in US 4,015,055 and the structure of the crimped cells shown in Reidl's Figs. 1-4. Since the cell construction shown in US 4,015,055 is clearly described as a crimped cell, then the cells shown in Reidl's Figs. 1-4 should be viewed as disclosing crimped cells. Therefore Reidl discloses crimped cells and not the non-crimped cells claimed by the applicant.


With regard to the word "crimping" as it is used in Reidl, see column 5, lines 58-62, which read as follows: "The cell cup is then assembled, with interposition of the conventional seal, and then the portion of the cover blank which is to form the contact cup is subjected to bending down or crimping with interposition or an additional seal." Reidl clearly discloses that the cell shown in Fig. 5 is a crimped cell. Although the examiner did not specifically rely upon Fig. 5 in the 102 (b) rejection, the crimped portion of the cell shown in Fig. 5 is also shown in

Figs 2 and 3 which were relied upon by the examiner. Consequently, Figs 2 and 3 should also be viewed as disclosing crimped cells.

Claim 5 stands rejected under 35 U.S.C. 103 (a) as being unpatentable over Reidl in view of either US patent numbers 4,690,879 (Huhndorff) or 4,401,733 (Shirai). Claim 5 has been canceled.

Claims 1 and 2 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-14 of U.S. Patent No. 6,605,383 (Wu). This rejection has been overcome by the filing of the enclosed Terminal Disclaimer to Obviate a Double Patenting Rejection Over A Prior Patent.

For the reasons described above, the applicant submits that claims 1-4 and 6-7 are in condition for allowance.



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Attachment A

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Art Unit: 1745

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The Examiner respectfully disagrees.

The term crimping in the battery art means pressing or pinching into small, regular folds or ridges. Riedl does not explicitly employ the term crimped in the written description. Fig. 1 does not show crimping (pressed or pinched regular folds or ridges) contrary to Applicant's assertion. Therefore Fig. 1 is not held to teach or suggest a crimped cell.

Applicant alleges that the housing 1 has an open end that has been crimped inwardly thereby compressing the seal 3 against the first terminal 2. Applicant appears to be inaccurately employing the term crimped as the term is defined above. The housing 1 in Fig. 1 does not represent a crimped inner housing since there is an absence of pressed or pinched regular folds or ridges, the definition of a crimped configuration.

None of the remaining figures of Riedl teach or suggest a cover 4 with a crimped peripheral wall or a container 1 with a crimped open end.

Therefore, Fig. 1 is representative of a non-crimped alkaline electrochemical cell where neither the peripheral wall of the cover nor the open end of the container are crimped, and is held to anticipate the claims as set forth above.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

Attachment B1

United States Patent [19]

Langan et al.

[11] **4,015,055**[45] **Mar. 29, 1977**[54] **METAL OXIDE CELLS HAVING LOW INTERNAL IMPEDANCE**[75] Inventors: Richard Allen Langan, Parma;
Nicholas Joseph Szulbanich, Rocky
River; Akiya Kozawa, Middleburg
Heights, all of Ohio[73] Assignee: Union Carbide Corporation, New
York, N.Y.

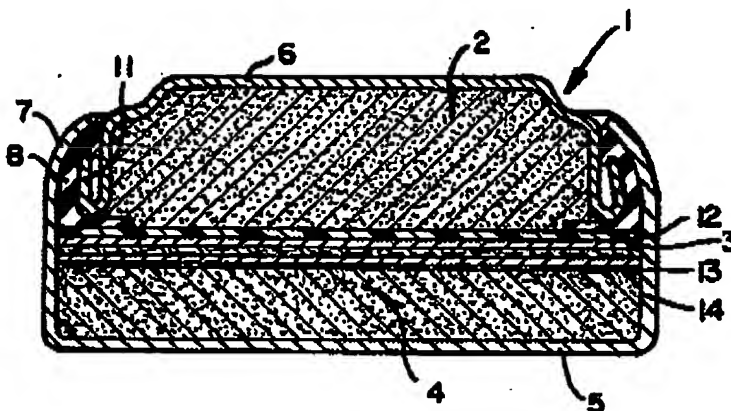
[22] Filed: Sept. 29, 1975

[21] Appl. No.: 617,636

[52] U.S. Cl. 429/145; 429/237

[51] Int. Cl.¹ H01M 6/06[58] Field of Search 136/107, 106, 102, 137,
136/138, 20, 23, 24, 146; 429/144, 145, 162,
164, 206, 207, 209, 219, 220, 222, 237, 241,
245, 224, 218[56] **References Cited****UNITED STATES PATENTS**2,654,795 10/1953 Brill et al. 136/120
3,457,117 7/1969 Angelovich 136/107 X3,476,610 11/1969 Krebs et al. 136/107
3,485,672 12/1969 Ruben 136/24
3,853,623 12/1974 Davis 136/20
3,907,598 9/1975 Megahed 136/107*Primary Examiner—John H. Mack**Assistant Examiner—C. F. Lefevour**Attorney, Agent, or Firm—Cornelius P. O'Brien*[57] **ABSTRACT**

A metal oxide alkaline cell, such as a silver oxide-zinc cell, having a negative electrode, an alkaline electrolyte, a positive electrode comprising for example divalent silver oxide housed in a positive terminal container, a separator disposed between the negative electrode and the positive electrode, and wherein a thin porous, electronically conductive layer, such as a gold layer, is disposed between the positive electrode and the separator and is extended to contact the positive terminal container.

13 Claims, 5 Drawing Figures

Attachment B2

4,015,055

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greater control over the exact location of the conductive material is needed or desired. Alternatively, a disk of material carrying a thin conductive layer may be placed in the cell between the cathode and separator with the conductive layer contacting both cathode and cathode container. The disk could suitably be made of a material which may ultimately dissolve or swell in the cell electrolyte and if it dissolves, it should be a material that would not increase the cell resistance. Placement of the conductive layer onto the cathode or separator surface prior to cell assembly might also be done from a suspension of a conductive material in a suitable liquid medium. Of the above, the vacuum deposition method is preferred because of the coating uniformity achieved even with very thin layers. Of the above-mentioned conductive materials, gold would be preferred because it is a good electronic conductor and can be deposited on a substrate in a very thin layer. Regardless of what material is selected for the conductive layer it must be a good electronic conductor, be oxidation-resistant in the cell environment or at least remain electrically conductive if oxidized, have low solubility in the cell electrolyte and have no adverse effect on the stability of the active cathode material.

In addition to the use of a conductive layer at the cathode-separator-cathode collector interfaces, the abnormally high cell internal resistance during initial discharge can be also reduced by substantially filling all the voids in the cathode with the electrolyte of the cell. This latter feature also helps to provide a higher, more stable voltage level throughout discharge. Thus the combination of employing a thin electronically conductive layer interposed at the interface of the cathode and separator and extending to contact the cathode collector and the addition of extra electrolyte to insure that the voids in the cathode are effectively filled will produce a cell having a discharge voltage substantially level throughout discharge and particularly during the initial discharge period of the cell.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of a miniature button size metal oxide cell having a electronically conductive layer at the interface of the separator and cathode and extending along the side wall of the cathode thereby contacting the cathode collector or container.

FIG. 1A is an enlarged view of a section of FIG. 1 showing the location of the conductive layer in greater detail.

FIG. 2 shows curves of the discharge voltages of a silver oxide-zinc cell employing an electronically conductive layer in accordance with the teachings of this invention.

FIG. 3 shows curves of the discharge voltages of a silver oxide-zinc cell of the prior art.

FIG. 4 shows curves comparing the discharge voltage of two miniature silver oxide-zinc cells, one cell employing a conductive layer in accordance with the teachings of this invention and the other cell made without such a conductive layer.

Referring to FIG. 1, there is shown a sectional elevation of a metal oxide cell having a negative electrode 2, separator 3, and positive electrode 4 housed within a two-part container comprising a cathode container 5 and anode cup 6. As shown, cathode container 5 has a flange 7 which is crimped inwardly against a U-shaped flange 11 on anode cup 6 via grommet 8 during assembly to seal the cell as disclosed, for example, in U.S.

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Pat. No. 3,069,489. The cathode container may be of nickel-plated steel, nickel, nickel alloys, stainless steel, or the like, while the anode cup 6 may be made of tin-plated steel, copper-clad stainless steel, gold-plated copper-clad stainless steel, or the like. The grommet 8 may be made of a suitable resilient electrolyte-resistant material such as neoprene, nylon, or the like.

The separator 3 may be a three-layer laminate consisting of two outer layers of radiation-grafted polyethylene and an inner cellophane layer or the like. Disposed between anode 2 and separator 3 is a layer of electrolyte-absorbent material 12 which may consist of various cellulosic fibers.

The anode (negative) electrode can comprise a lightly compressed pellet 2 of finely divided amalgamated zinc containing, if desired, a gelling agent. Cadmium may also be used as the anode material. The cathode (positive) electrode can comprise a rather densely compressed pellet 4 of a metal oxide powder such as divalent silver oxide powder which could comprise a mixture of divalent silver oxide powder and monovalent silver oxide powder.

The cell electrolyte may be an aqueous solution of potassium hydroxide, sodium hydroxide, or mixtures thereof.

As shown in FIGS. 1 and 2, a porous electronically conductive layer 13 is disposed at the interface of the separator 3 and cathode 4 and extends partially downward over the side wall 14 of cathode 4 thereby contacting the inner upstanding wall 15 of container 5. The positioning of the conductive layer as shown in FIGS. 1 and 2 as being at the interface of cathode 4 and separator 3 and extending along the side wall 14 in contact with upstanding wall 15 of container 5 will effectively reduce the internal cell resistance during initial discharge of the cell. Although not shown, the conductive layer could have been disposed on the surface of the separator facing the cathode and extended onto the side wall of the separator where it would contact the upstanding wall of the container.

It is also within the scope of this invention to connect two or more such cells in series or parallel by conventional means and then place them in a housing to produce a battery which can be used in various battery-operated devices.

EXAMPLE I

Two miniature button cells of the general type shown in FIG. 1 were made except that a zinc screen was interposed between the cathode and the inner bottom surface of cathode container as disclosed in U.S. application Ser. No. 482,996. The cells, having a diameter of 0.450 inch (1.14 cm.) and an overall height approximately 0.160 inch (0.40 cm.), were produced using a gelled zinc powder anode, a pellet of active cathode material of 50/50 by weight Ag₂O/Ag₂O molded at about a 2-ton pressure and a three-layer separator consisting of two outer layers of cellophane and an inner layer of radiation grafted polyethylene. An additional electrolyte-absorbent separator composed of two layers of a rayon material was employed adjacent to the anode. These components, along with a 33% KOH electrolyte (7.7 M KOH) which was employed in an excessive amount so as to effectively fill the voids of the cathode material, were assembled in a nickel-plated cathode container and a gold-plated copper-clad stainless steel anode cup and then the cell was sealed by crimping the top annular section of the cathode con-

Attachment B3

4,015,055

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tainer inwardly against the anode cup via a grommet of nylon as described in U.S. Pat. No. 3,069,489.

Each cell was made identically except that in one of the cells a gold layer was vacuum deposited on the top surface of the cathode facing the separator and extended over the side wall as shown in FIG. 1. The amount of gold employed was about 600 micrograms per square inch.

Both of the cells were tested on a 20 milliamperere drain for over 2 hours. The voltage data for the cell employing the gold layer in accordance with this invention (Cell A) are shown plotted as curve A in FIG. 2. The data of the corresponding discharge voltages for the cell not having the gold layer (Cell A') are shown plotted as curve A' in FIG. 3. Using the test procedure as disclosed in the Journal of Electrochemical Society, Vol. 107, No. 6 June 1960 and Vol. 119 No. 8 Aug. 1972, the resistance-free discharge voltage was observed for the cell with the gold layer and the cell without the gold layer and the data obtained were plotted as curves B and B' in FIGS. 2 and 3, respectively. As is apparent from FIGS. 2 and 3, the cell without the gold layer exhibited a higher internal resistance during initial discharge and took over fifteen minutes before the voltage exhibited the normal or expected voltage level. The normal or expected voltage level for cells of the type tested was found to be about 0.060 to 0.085 volt lower than the resistance-free discharge voltage. The cell employing a gold layer exhibited a substantially lower internal resistance than the cell without a gold layer and therefore was able to exhibit a discharge voltage curve substantially parallel to the resistance-free discharge voltage curve. Thus the cell containing the gold layer displayed the expected discharge voltage immediately on discharge.

To further confirm the above observations, the a.c. impedance of the cells was measured both before and after discharge at 40 and 1000 Hertz. The data observed are shown in Table 1 and confirm that the internal cell impedance is lower before discharge for a cell employing a gold layer as opposed to a cell not having a gold layer.

EXAMPLE 2

Two cells, identical to the miniature button cells of Example 1 had an additional amount of the electrolyte added as in Example 1 to insure that the voids of the cathode were effectively filled with the electrolyte. Each cell was discharged at 70° F. across a 140,000-ohm continuous load and for 1.25 seconds of every 10 minute period the cell was discharged across a 30-ohm load. This pulse discharge regime represents simulated operating conditions of battery-powered watches which require high current pulses for proper operation.

The discharge voltage data for both the cell without the gold layer and the cell with the gold layer on a 140,000-ohm continuous load were observed to be substantially the same and thus are shown as a single curve in FIG. 4 identified as curve A.

TABLE 1

Cell Sample	Cell Impedance (ohms)			
	40 Hertz		1000 Hertz	
	Before Discharge	After Discharge	Before Discharge	After Discharge
Cell A	10.5	2.8	4.0	2.7

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TABLE 1-continued

Cell Sample	Cell Impedance (ohms)			
	40 Hertz		1000 Hertz	
	Before Discharge	After Discharge	Before Discharge	After Discharge
Cell A'	32.0	2.3	19.0	2.1

The data obtained from the pulsed 30-ohm load test were plotted as points on the graph of FIG. 4 and then the points were connected to yield curve B for the cell employing a gold layer and curve C for the cell without a gold layer. As is apparent from the curves in FIG. 4, the initial voltage discharge level for the cell without the gold layer (curve C) took over 100 hours before it reached the 1.2 volts level thus indicating that during this period it may not supply sufficient power to operate a battery-powered watch. Contrary to this, the cell employing a gold layer in accordance with this invention exhibited an initial discharge voltage level above 1.2 volts immediately upon discharge and continued to exhibit such a voltage level for in excess of 1200 hours. This comparison of curves B and C clearly demonstrates that using the teaching of this invention the internal resistance or impedance of a silver oxide-zinc cell can be greatly reduced during initial discharge so as to make it suitable for various battery-powered devices such as watches.

It is to be understood that other modifications and changes in the preferred embodiments of the invention herein shown and described can also be made without departing from the spirit and scope of the invention. In addition, this invention is admirably suited for use with silver oxide-zinc cells as disclosed in U.S. patent applications Ser. No. 482,996 and Ser. No. 483,014, identified above, to produce cells having a substantially unipotent discharge level on low drain conditions.

What is claimed is:

1. In a metal oxide alkaline cell comprising a negative electrode, a positive electrode housed in an electronically conductive container having a bottom and a side wall, a separator disposed between said negative electrode and said positive electrode, and an electrolyte, said positive electrode comprising a metal oxide wherein the improvement comprises a layer of electronically conductive material selected from the group consisting of gold, platinum, rhodium, palladium, lead, tungsten, tantalum, nickel, iron disulfide and lead oxide, said electronically conductive material being disposed solely at the interface of the separator and the positive electrode and extending sufficiently to contact the wall of the conductive container so as to decrease the internal resistance at the separator-cathode-cathode collector interfaces and thereby substantially eliminate the voltage variations usually associated with the initial discharge of metal oxide cells and said electronically conductive material being sufficiently porous so as not to effectively interface with the ionic flow between the negative and positive electrodes of the cell.

2. In the metal oxide alkaline cell of claim 1 wherein the electronically conductive material of said layer is present in an amount between about 130 micrograms per square inch and about 3000 micrograms per square inch based on the surface area of the positive electrode facing the separator.